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ABSTRACT

This paper examines the characteristics of information as a resource and the implications of so regarding information. Information is defined as the sum total of all facts and ideas available to be known by somebody at a given moment in time, while knowledge results from selecting and organizing facts and ideas into what will be useful to somebody. Wisdom is integrated knowledge which crosses disciplinary barriers to weave into an integrated whole something that becomes more than the sum of its parts. The "informatisation" of society can be seen in the growth of information jobs both nationally and internationally. Information is coming to be regarded as a resource. As such, it has the following characteristics: it is expandable; compressible; substitutable (able to replace capital, labor, or physical materials); transportable; diffusive (tends to leak); and shareable. The information resource is different in kind from other resources. Treating information as a resource has enormous implications for human life; it raises questions in political economy, economics, law, accounting, and education. The information revolution will also cause a reorganization of power and authority, with more openness as a technological imperative in a democracy. (ESR)

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Information As a Resource

by Harlan Cleveland

no. 2

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(212) 475-0850

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Harlan Cleveland, political scientist and public executive, is professor and director of the University of Minnesota's Hubert H. Humphrey Institute of Public Affairs.

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In a remarkably short span of about ten years, the once prescient notion that industrial society was being transformed into a "post-industrial," "information," or "knowledge" society has become a cliche.

We are already past the jaw-dropping, gee-whiz stage of technological wonder, and have internalized, even if most of us do not really understand, the prospect of trillions of transactions performed in nano-seconds of time. But we have not yet gotten very far in learning how to think about the implications of the information society's technical wizardry for the way we live, work, and play. The hardware can come up with the answer in seconds and communicate it around the world in minutes, but have we asked the right question?

Part of the problem in considering these questions is that we're still struggling with definitions of basic terms, including the very word "information." The hierarchy suggested long ago by T.S. Eliot in *The Rock* is a useful starting point: "Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?"

In my lexicon, *information* is the ore, the sum total of all the facts and ideas that are available to be known by somebody at a given moment in time. *Knowledge* is the result of somebody applying the refiner's fire to the mass of facts and ideas, selecting and organizing what is useful to somebody. Most knowledge is expertness -- in a field, a subject, a process, a way of thinking, a science, a "technology," a system of values, a form of social organization and authority. *Wisdom* is integrated knowledge -- information made super-useful by creating theory rooted in disciplined knowledge but crossing disciplinary barriers to weave into an integrated whole something more than the sum of the parts. (The distinction between information and knowledge -- or knowledge and wisdom -- is, of course, subjective. One person's information may be another's knowledge; one person's wisdom may be another's wisecrack.)

It is probably not important to search for universal agreement on the distinctions between knowledge, information, and wisdom. There are many ways to make these distinctions, each of which can help clear intellectually muddied waters in certain contexts. Daniel Bell defines information as "data processing in the broadest sense" and knowledge as "an organized set of statements of facts or ideas ... communicated to others."

A colleague at the University of Minnesota, Yi-Fu Tuan, organized the T.S. Eliot hierarchy this way:

> ...The difference is one of order of complexity. Information is horizontal, knowledge is structured and hierarchical, wisdom is organismic and flexible. Any diligent student can, with the help of a computerized system, acquire vast amounts of information; for instance, the population of every township in the United States. But the data are pretty useless because they are stretched out at one level. (Information is horizontal.) For the data to be useful -- come to life, as it were -- they have to be linked to another rung or category of data. The result is knowledge. (Knowledge is structured and hierarchical.) Every teacher knows how difficult it is to pass knowledge, as distinct from information, to students; hence, we give objective tests to determine how much information, rather than knowledge, they have acquired. As for imparting wisdom, it ... has to do with personal chemistry and slow osmosis.

The 'Informatisation' of Society

While we may not agree on precise definitions, we can probably take as common ground the size and scope of the transition we are in: the "informatisation" of society. (The new word rolls off the tongue more readily in French than in English.) Both the size and scope are impressive, if still largely impressionistic:

- A century ago, fewer than 10% of the American labor force were doing information work; now more than 50% of us may be engaged in it. The actual production, extraction, and growing of things now soak up less than a quarter of our human resources. Of all the rest, which used to be lumped as "services," perhaps two-thirds are information workers.
- It is not only in the United States that the informatisation of society has proceeded so far so fast. A recent study by the Organization for Economic Cooperation and Development puts the average information labor force of several of its member countries at one-third of the total during the early- to mid-1970s. That same study indicates that the information component of the labor force increased its share of the total by 2.8% during each five-year period since World War II.

• While having fewer laborers in production and more in services is not new, what is new is the pace of change made possible by the converging revolutions of computers and telecommunications along with the dawning mass realization that something very large and important is occurring under our very noses. When a much-read philosopher of business administration such as Peter Drucker starts calling knowledge "the central capital, the cost center, and the crucial resource of the economy," non-philosophers preoccupied with the managing of organizations have to sit up and take notice.

My University of Minnesota colleague G. Edward Schuh says, "All of the increase in agricultural output from the mid-1920s through the mid-1970s (a 50-year period!) came about with no increase in the capital stock of physical resources. It was all due to increases in productivity, with most of that due to new knowledge or information. That makes clear the extent to which knowledge is an input or resource."

• What is also new is a theory crisis, a sudden sense of having run out of basic assumptions. We have carried over into our thinking about information (which is to say symbols) concepts developed for the management of things -- concepts such as property, depletion, depreciation, monopoly, market economics, the class struggle, and top-down leadership. But as Simon Nora and Alain Minc say in their report to the President of France: "The liberal and Marxist approaches, contemporaries of the production-based society, are rendered questionable by its demise." The assumptions we have inherited are not producing satisfactory growth with acceptable equity either in the capitalist West or in the socialist East. Maybe it would help if we stop treating information as just another *thing*, and look hard at what makes it so special.

If information is a resource, it is unique among resources. The resources I learned about in school were tangible: minerals, fuel, food. During my career in the U.S. government, I helped buy and sell resources for the Board of Economic Warfare, transferred resources to other countries through the Marshall Plan and the early foreign-aid programs, argued about "sovereignty over national resources" in U.N. committees, and helped mobilize resources for defense in NATO. In these and other assignments I have brought people ("human resources") together in organizations to manage things and to manage ideas about things. We never said "to manage information."

We have grown up thinking of business as built on resources-as-things. But the physical component of most business now is a small base for an inverted pyramid of organized information. Most people in business now work on ideas, procedures, marketing, advertising, administration, and trying to stay out of trouble with the consumers, the regulators, and the law.

By the same token, the American labor movement was built by and for people who worked with things; its main power base is still in automobiles, steel, freight transportation, metal-working, and other crafts. But thing-oriented work is now the province of a dwindling minority of the U.S. labor force. More and more of the organized workers, and the great bulk of the unorganized, are working in services, and most of the service employees are in information work.

The Characteristics of Information

If information (through being refined into knowledge and wisdom) is now our "crucial resource," what does that portend for the future? The inherent characteristics of information now coming into focus give us clues to the vigorous rethinking that must now begin:

1. INFORMATION IS EXPANDABLE.

Some information for some purposes is certainly depletive over time -- yesterday's weather forecast is of merely historical interest tomorrow -- but for the most part, as John and Magda McHale were already saying a decade ago, information expands as it is used (see John McHale, *The Changing Information Environment,* Westview Press, 1975). Whole industries have grown up to exploit this characteristic of information: scientific research, technology transfer, computer software (which already makes a much bigger contribution to the GNP than the manufacture of computer hardware), and agencies for publishing, advertising, public relations, and government propaganda to spread the word (and thus to enhance the word's value).

Because information is expandable without any obvious limits, the facts are never all in -- and facts are available in such profusion that uncertainty becomes the most important planning factor. The further a society moves toward making its living from the manipulation of information, the more its citizens will be caught up in a continual struggle to reduce the information overload on their desks and in their lives in order to reduce the uncertainty about what to do. In the information society, we

trade glut for scarcity, flood for drought. To find that our "crucial resource" is not scarce does not mean that life will be easier. But it certainly will make life different.

The ultimate "limits to growth" of knowledge and wisdom are *time* (time available to human minds for reflecting, analyzing, and integrating the information that will be "brought to life" by being used) and the *capacity* of people -- individually and in groups -- to analyze and think integratively. There are obvious limits to the time each of us can devote to the production and refinement of knowledge and wisdom. But the capacity of humanity to integrate its collective experience through relevant individual thinking is certainly expandable -- not without limits we cannot now measure or imagine.

2. INFORMATION IS COMPRESSIBLE.

Paradoxically, this infinitely expandable resource can be concentrated, integrated, summarized -- miniaturized, if you will -- for easier handling. We can store many complex cases in a single theorem, squeeze insights from masses of data into a single formula, capture many lessons learned from practical experience in a manual of procedure. By selecting and compressing information to produce knowledge and wisdom, some information is bound to be lost; what is lost may turn out to be trivial or merely interesting, but it could also turn out to be crucially relevant.

3. INFORMATION IS SUBSTITUTABLE.

It can replace capital, labor, or physical materials. Robotics and automation in factories and offices are displacing workers and thus requiring a transformation of the labor force. Workers who have previously helped grow or extract or make things, or who have been in the non-information services, will have to learn to become information workers -- or get used to being unemployed. This transformation may affect up to 45 million workers by the year 2000, according to Senator Gary Hart in a speech to the World Future Society Assembly on "Communications and the Future."

4. INFORMATION IS TRANSPORTABLE --

at the speed of light and perhaps, through telepathy, faster than that. In less than a century, we have been witness to a major dimensional change in both the speed and volume of human activity, a change in transportability of resources greater than the multi-millennial shift from foot travel to supersonic jets.

5. INFORMATION IS DIFFUSIVE.

It tends to leak -- and the more it leaks, the more we have. Information is aggressive -- even imperialistic -- in striving to break out of the unnatural bonds of secrecy in which thing-minded people try to imprison it. Like a virus (which is itself a tiny information system), information tries to affect the organisms around it -- whether by over-the-fence gossip or satellite broadcasting. The straitjackets of public secrecy, intellectual property rights, and confidentiality of all kinds fit very loosely on this restless resource.

6. INFORMATION IS SHAREABLE.

Shortly before his death, Colin Cherry wrote that information by nature cannot give rise to exchange transactions, only to *sharing* transactions. *Things* are exchanged; if I give you a flower or sell you my automobile, you have it and I don't. But if I sell you an idea, we both have it. And if I give you a fact or tell you a story, it's like a good kiss: in sharing the thrill, you enhance it.

A New Kind of Resource

The information resource, in short, is different in kind from other resources. So it has to be a mistake to carry over uncritically to the management of information those concepts that have proven so useful during the centuries when things were the dominant resources and the prime objects of commerce, politics, and prestige. These concepts include scarcity, bulk, limited substitutability, trouble in transporting them, and the notion of hiding and hoarding a resource.

A society in which information is the dominant resource is not necessarily "better" or "worse," fairer or more exploitative, cleaner or dirtier, or happier or unhappier than agricultural or industrial societies in which physical, tangible resources are dominant. The quality, relevance, and usefulness of information are not givens. They depend on who uses the information, in how refined a form, and for what purposes.

Implications for Human Life

The implications of treating information as a resource are enormous, for life-styles and workways, for human community and inhuman conflict.

The implications, I believe, are especially great for changes in the way we think about life, work, community, and conflict. The theories (assumptions, preconceptions, ideologies,-- call them what you will) we

develop will arrange "the facts" and determine how we resolve, for our time and place, the historic social dilemmas -- freedom vs. organization, autonomy vs. authority, participation vs. action, growth vs. equity, war vs. peace.

If our dominant resource is now expandable, compressible, substitutable, highly transportable, diffusive, and shareable, what are the implications for some of our favorite and predominant theories and assumptions?

- In political economy, won't the concept of market "exchange" have to take account of the fact that more and more of our economic activity now consists of what are by nature "sharing" transactions?
- In economics, why are we still focusing on the allocation of scarcities when there is a chronic surplus of information resources?
- In law, how should we adapt the concept of property in facts and ideas when the widespread violation of copyrights and the shortened life of patent rights have become the unenforceable Prohibition of our time? Aren't we going to have to invent different ways to reward intellectual labor that are compatible with a resource that is both diffusive and shareable? Aren't the laws governing privacy and the regulations governing telecommunications already outmoded by technology, which does not wait around for legislative hearings or court calendars?
- In accounting, what are we to do with a concept called "depreciation" in a society where a large fraction of its resources does not depreciate with use?
- In education, doesn't the information environment place a much greater premium on integrative thought? Won't we have to take a new look at a system that awards the highest credentials for wisdom to people with the narrowest slices of knowledge? And as the education required to be functionally literate in an information society keeps growing in depth and breadth, what is to become of those who, because they lack basic education or the opportunity for continued learning, become the peasants of the knowledge society?

In the new information environment, we will have to rethink the very nature of rule, power, and authority because the information revolution is producing a revolution in the technology of organization.

Information has always been the basis of human organization, of course. People with better or more recent information -- generals with

fast couriers, kings with spies and ambassadors, etc. -- held sway over the rest of mankind. But once information could be rapidly collected and analyzed, instantly communicated, and readily understood by millions, the power monopolies that closely held information made possible were subject to accelerating erosion.

Leadership of uninformed people was likely to be organized in vertical structures of command and control. Leadership of the informed is more likely to result in effective action if it is exercised mainly by persuasion, with wider participation and more collective thought.

With nobody completely in charge but everybody partly in charge, collegial rather than command structures are the more natural basis for organization. "Planning" cannot be done by a few leaders, advised in secret by experts with detailed blueprints; "planning" has to be a dynamic improvisation by the many according to a general sense of direction that is announced by "leaders" only after genuine consultation with those who will have to improvise on it.

Participatory decision-making implies a need for much feedback information, widely available and seriously attended. That means more openness and less secrecy -- not as an ideological preference but as a technological imperative. In the Information Society, maybe that's the updated definition of democracy.